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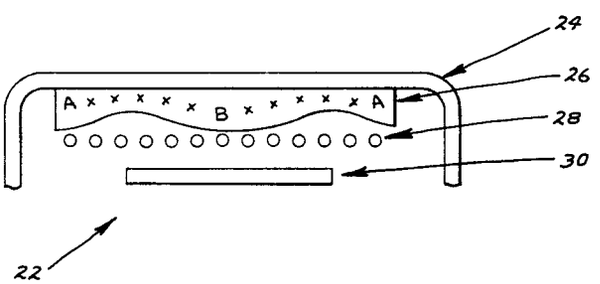
(54) Bubble memory structure.

(57) A bubble memory structure includes a magnetic field shield (24, 34), a bubble memory chip (30, 42) within said shield means; means (28, 40) for generating a rotating magnetic field in the vicinity of said bubble memory chip; and a permanent magnet (26, 38) so shaped as to produce a bias magnetic field which is substantially uniform over the antire bubble memory chip.



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"BUBBLE MEMORY STRUCTURE"

This invention relates to bubble memory structures.

According to one aspect of the present invention, there is provided a bubble memory structure including: a magnetic field shielding means; a bubble memory chip within said shield means; means for generating a rotating magnetic field in the vicinity of said bubble memory chip; and characterised by permanent magnet means so shaped as to produce a bias magnetic field which is substantially uniform over the entire bubble memory chip.

In one embodiment, said permanent magnet means is a permanent magnet which is thicker in a central region disposed adjacent said bubble memory chip than in regions disposed adjacent to the edges of said chip.

In another embodiment, said permanent magnet means is a permanent magnet of substantially constant thickness and contoured to be closer to said bubble memory chip at a central area than in regions disposed adjacent to the edges of the chip.

The permanent magnet means may be made of a ceramic material such as barium ferrite ceramic.

The permanent magnet means may comprise two similarly shaped permanent magnet means disposed on opposite sides of said bubble memory chip.

The invention is illustrated, merely by way of example, in

the accompanying drawings in which:-

Figure 1 is a cross-section of a known bubble memory structure;

Figure 2 is a partial cross-sectional view of one embodiment of a bubble memory structure according to the present invention; and

Figure 3 is a partial cross-sectional view of another embodiment of a bubble memory structure according to the present invention.

Referring now to Figure 1, a known bubble memory structure 10 has a shield 12. Within the shield 12 are two permanent magnets 14. A levelling or smoothing plate 16 is disposed adjacent each magnet and adjacent each plate 16 there is a field coil 18. A bubble memory chip 20 (shown diagramatically) is provided in the centre of the bubble memory structure 10 between the field coils 18. The magnets 14 are planar. The plates 16 are of a high permeability material to help level the loss of flux density normally occuring in the central area of the magnets. These plates 16 are usually adjacent to the respective field coils 18. Since the field coils operate at a frequency of the order of 100 to 400 kHz, high eddy current and hysteresis losses can occur if the plates 16 are not formed of low loss materials such as linear ferrite.

The magnetic flux in the central area of the bubble memory structure of Figure 1 is reduced by so-called "self-demagnetizing forces". It is possible to offset the effects of the self-demagnetizing forces by increasing the magnetic forces in the central area of the plates 16. One way of increasing the magnetic force of a magnet is to increase its

"length" which corresponds to an increase in its thickness Generally, the amount of magnetic material comprising a magnet is increased to increase magnetic flux.

Figure 2 shows an embodiment of a bubble memory structure 22 according to the present invention in which the magnetic forces are of relatively increased strength in its central area as a result of increasing its "length" or effective thickness. Thus, the bubble memory structure 22 has a shield device 24, a contoured permanent magnet 26, a field coil 28 for generating a rotating magnetic field and a bubble memory chip 30. Since the bubble memory structure is symmetrical about the bubble memory chip 30, it is only partially shown. The magnet 26 is preferably made of low permeability material having a high electrical resistance, such as a ceramic material. More particularly, the magnet may be made of a barium ferrite ceramic. The magnet 26 may be formed in any of a variety of known ways with the appropriate materials. The magnet 26 has its thickness, and therefore its strength, increased at edges A to offset the effect of fringe magnetic fields. This fringe edge effect needs to be offset only if the ultimate size of the magnet must be reduced for the bubble memory chip 30. Further, at the central area B of the magnet, the thickness of the magnet is increased to offset the self-demagnetization forces which occurs as a result of a comparatively high area-to-length ratio. This local variation in magnetic flux density creates a uniform field at the bubble chip.

Referring now to Figure 3, another embodiment of a bubble memory structure 32 according to the present invention is shown. As before, a shield 34 surrounds a field coil 40 and a bubble memory chip 42. A filler plate 36 is provided immediately internally of the shield 34 and is of an appropriate shape to hold a magnet 38. The actual thickness

of the magnet 38 is uniform whereas the thickness of the magnet 26 as shown in Figure 2 is non-uniform. However, the effective thickness of the magnet 38 is varied. The required variation of the magnetic flux density at the bubble memory chip 42 shown in Figure 3 to compensate for self demagnetizing forces, is produced as a result of the spacing between the magnet and the chip. Thus, the plate 36 causes the magnet 38 to have a very small air gap in the central region where the magnet produces the weakest magnetic field. Although the air gap in Figure 3 is only represented diagramatically, the actual gap being much smaller than that represented, the principle is that the effect of the magnetic field is enhanced where the magnet itself is weakest by establishing a greater effective thickness by having a shorter effective magnetic flux path.

Further variations of the embodiment shown in Figure 3 involves shaping the shield 34 in a contoured fashion to eliminate the plate 36.

CLAIMS

1. A bubble memory structure including a magnetic field shielding means (24,34); a bubble memory chip (30,42) within said shield means; means (28,40) for generating a rotating magnetic field in the vicinity of said bubble memory chip; and characterised by permanent magnet means (26,38) so shaped as to produce a bias magnetic field which is substantially uniform over the entire bubble memory chip.

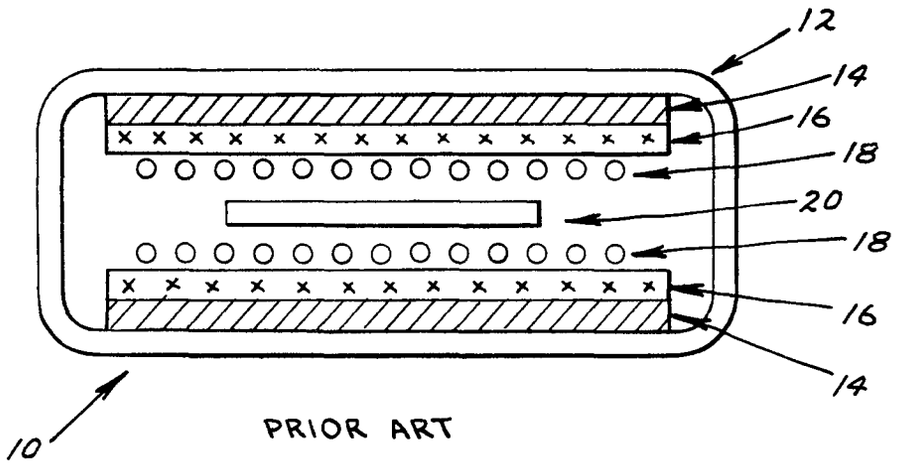
2. A structure as claimed in claim 1 characterised in that said permanent magnet means is a permanent magnet (26) which is thicker in a central region disposed adjacent said bubble memory chip than in regions disposed adjacent to the edges of said chip.

3. A structure is claimed in claim 1 characterised in that said permanet magnet means is a permanent magnet (38) of substantially constant thickness and contoured to be closer to said bubble memory chip at a central area than in regions disposed adjacent to the edges of the chip.

4. A structure as claimed in any preceding claim characterized in that the permanent magnetic means (26,38) are made of a ceramic material.

5. A structure as claimed in any preceding claim characterized in that the permanent magnetic means (26,38) are made of a barium ferrite ceramic.

6. A structure as claimed in any preceding claim characterized in that the permanent magnetic means (26,38) comprises two similarly shaped permanent magnet means disposed on opposite sides of said bubble memory chip.



PRIOR ART

FIG. 1

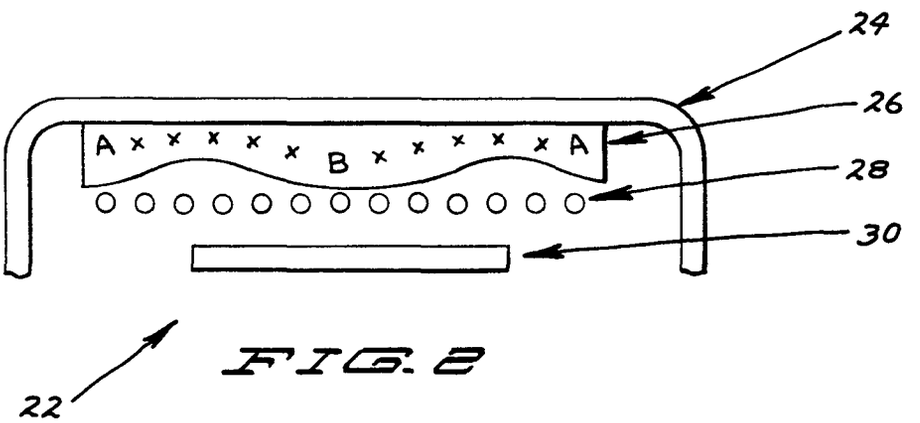


FIG. 2

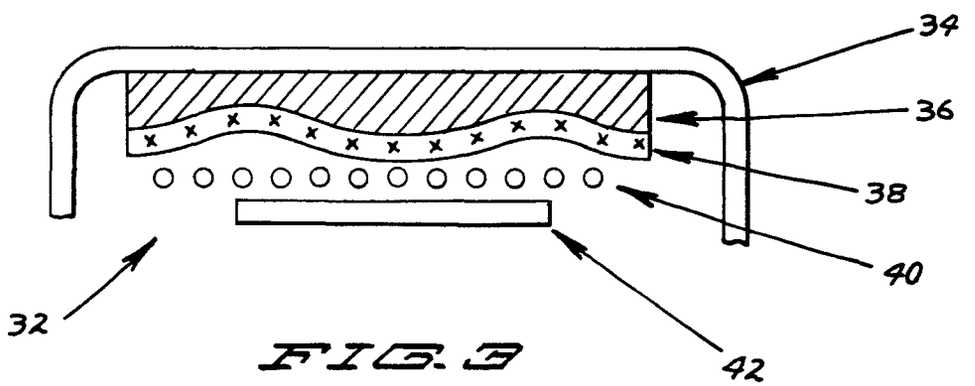


FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

0031647

EP 80 30 4162

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	FR - A - 2 384 322 (PLESSEY HANDEL UND INVESTMENTS) * From page 2, line 24 to page 4, line 21; figures 1-3 *	1-5
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	US - A - 3 931 618 (HEWLETT-PACKARD) * From column 1, line 55 to column 2, line 19; figure 1 *	1,5,6
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	US - A - 4 091 362 (ROCKWELL INTERNATIONAL) * From column 2, line 48 to column 4, line 10; figures 1,2 *	1,2,6

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

G 11 C 19/08

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

G 11 C 19/08

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	02-04-1981	DEGRAEVE

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